

Shaler returned from it to find even neutral Kentucky divided within itself; and soon, though the chief actor tells us nothing of it, "Shaler's battery" became known upon the Union side.

Shaler married in 1862; but his wife refers us to his various writings on the war, and quotes very little from letters written to her from the field. The advance of Rosecrans on Nashville left Kentucky outside the crash of armies, and no echo reaches us of the bitter days round Chattanooga. It is of far more importance to Mrs. Shaler to record—and this was probably the feeling of all who knew her husband—that in 1864 Shaler was appointed assistant in palæontology in Harvard University. In 1869 he became professor of this subject, when only twenty-eight; then he was made professor of geology; and in 1891 he was chosen as Dean of the Lawrence Scientific School. Even his position from 1874 to 1880 as Director of the Geological Survey of Kentucky did not break his connection with the development of Harvard. For more than forty years, down to his death in 1906, he was one of the most familiar figures in the courts of the university.

Chapter xix., which deals with a visit to England, contains characteristic mention of Tyndall, and of several English geologists. Here, as in other places, some proper names have gone astray. The Rev. Mr. Simons of p. 256—have we not made the same rural journey to enjoy a meeting at his gate?—must surely be the late W. S. Symonds, the friend of all naturalists in the Midlands. Elsewhere we have "Renivier," "Guinitz," "Geoffrys" for Jeffreys, and "Marais," as we may presume, for "Marey." These slips result from copying out of diaries, where the incidents of the day have been set down. The incidents thus recorded, page after page, seem rarely of value in themselves; yet it is clear that we may end this notice much as we began. To those for whom the book is written, those whom Shaler had helped or stood by as a friend, nothing about Shaler will seem unworthy to be expressed.

GRENVILLE A. J. COLE.

#### MATHEMATICAL TEXT-BOOKS.

- (1) *Geometry for Beginners*. By C. Godfrey and A. W. Siddons. Pp. x+79. (Cambridge: University Press, 1909.) Price 1s.
- (2) *The School Geometry*. Parts i. and ii. By W. P. Workman and A. G. Cracknell. Part i., pp. viii+248. Part ii., pp. viii+(233-383). (Cambridge: University Tutorial Press, Ltd., 1909.) Price 2s. each part.
- (3) *Coordinate Geometry*. By H. B. Fine and H. D. Thompson. Pp. viii+300. (London: Macmillan and Co., Ltd., 1909.) Price 6s. 6d. net.
- (4) *Exercise Papers in Elementary Algebra*. By the Rev. E. M. Radford. Pp. viii+112. (London: J. M. Dent and Co., 1909.)
- (5) *Problem Papers in Mathematics*. By R. C. Fawdry. Pp. vii+240. (London: Macmillan and Co., Ltd., 1909.) Price 4s. 6d.
- (1) **I**N the light of the experience gained in the last eight years or more, it is now possible to estimate, with considerable accuracy, the effect of

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the numerous changes which have been made in the methods of teaching elementary geometry. The circular issued by the Board of Education last March contains a report on this subject which is well worth careful perusal. The central feature of the modern movement has been an attempt to familiarise the pupil with the fundamental concepts by experimental methods, before providing him with formal proofs. It is now suggested that this experimental stage, by being made more systematic, should *replace* the first part of the present deductive course. The properties of parallel lines and congruent triangles possess a characteristic which pertains to few, if any, of the later theorems. Once a pupil clearly apprehends their significance, which is possible only by experimental work, he is convinced with absolute assurance of their truth; and this very fact only serves to increase the difficulties which surround the formal proof. In the words of the circular,

"to commence the subject by proving what seems to need no proof is a safe way to make boys think that the whole subject is artificial and unreal. It is much better to begin Euclidean, that is, deductive proofs at the point where their necessity can be appreciated—that is after these fundamental propositions—and where, therefore, the proof is a natural process, not subject to arbitrary or artificial rules."

If then these base-theorems are incorporated in the experimental stage, and if at the end of this course those fundamental concepts, which have been thereby assimilated, are allowed to be assumed without formal proof, the course of deductive geometry will open with the properties of areas of triangles and parallelograms, and continue with theorems on the circle. In this way, at the end of his first year, a pupil will have covered as much ground as at present is covered, in the majority of cases, only after two or three years.

The present excellent little volume has been compiled to cover the complete experimental course outlined above, and it follows in every respect, save one, the suggestions made by the Board of Education. It is, however, advised in the circular that riders should be excluded entirely from the experimental stage; although in this way time may be saved and greater emphasis placed upon the fundamental theorems, yet simple riders so frequently serve to illustrate a theorem, and, moreover, form a valuable introduction to the future deductive course, that we are firmly convinced that the authors are right in inserting a large number of easy deductive examples in the text. We have developed these considerations at some length, because we consider that the change now advocated is likely to exert a profound influence on the teaching of geometry, and that the more it is considered in all its bearings, the more advantageous it will appear.

(2) This is an abridged edition of the authors' work, entitled "Geometry: Theoretical and Practical," published about two years ago. In the present book a certain amount of theory which may be fairly considered to be beyond the range of the average school-boy has been omitted. The sequence adopted in the theoretical course is that of the Cambridge syllabus. Part i. contains the substance of Euclid books i., iii.; part ii. that of books ii., iv., vi., together with those

modern extensions, such as harmonic ranges and coaxial circles, which now form a customary part of the school course.

(3) In this treatise the elements of coordinate geometry are presented in a compact form. The first twelve chapters are devoted to the treatment of the line, circle, conic, and other curves, while the remaining six deal with the line in space and the surfaces of the second degree. The experience of the authors has led them to introduce a number of changes in the order of development of the subject. The equation of the straight line is given, before the customary work on lengths and areas; they advise the student to read the chapter on the parabola before that on the circle, thereby enabling him to see at an early stage how analytical methods may be used to obtain properties which are new to him. All mention of pole and polar properties is deferred until after the treatment of the general conic, and the application of Cartesian methods to the investigation of loci is postponed to the final chapter of the first part of the book.

The section on solid geometry, while omitting the more complicated analytical formulæ, is sufficiently thorough to enable the student to attack with success any problem on the geometry of the conicoid of a straightforward character. There are numerous exercises and diagrams. In every respect this book is admirably suited to meet the needs of those who are reading the subject for the first time.

(4) The range of work covered by Mr. Radford's useful book includes the binomial theorem and the exponential and logarithmic expansions. Quadratic equations and graphical solutions are introduced at the start, and logarithms appear at an early stage. There are also ten book-work papers.

(5) The papers set in recent examinations conducted by the Civil Service Commissioners have included a number of problems of a much more practical character than are to be found in the ordinary academic text-book. That this type of question is both stimulating and of real educational value is beyond question, but up to the present there has been no convenient collection of problems of this character. Mr. Fawdry's book now supplies exactly what is wanted. Primarily, it is intended for army candidates and students in technical colleges, but many of the papers contain practical questions of considerable intrinsic theoretical difficulty, and may therefore profitably be set to boys preparing for entrance college scholarships. A comprehensive set of revision papers adds materially to the utility of this first-rate book.

#### OUR BOOK SHELF.

*Ant Communities and How they are Governed. A Study in Natural Civics.* By Dr. H. C. McCook. Pp. xvii+321. (New York and London: Harper and Bros., 1909.) Price 7s. 6d. net.

For thirty-two years Dr. McCook has devoted much time and attention to the habits of American ants, and has published many popular works on the subject, in addition to the two large works on "The Agricultural Ants of Texas" and "The Honey Ants of the Garden of the Gods." In the present work, which is

based chiefly on his own original observations, he discusses the conditions of ant-life from a popular standpoint; and his sixteen chapters deal with such subjects as fraternal confederacies, nesting architecture, engineering, feeding the commune, language, government, dependents, war, aliens, aphid herds, slave-making, sanitation, &c.

Britain is very deficient, both as regards number of species and number of individuals; but the American species are more numerous, and the size of nests and communities of many species is almost incredible. Thus Dr. McCook writes:—"The large conical nests of the mound-making ants of the Alleghanies, *Formica exsectoides* vary in size from newly-begun colonies a few inches high to mature hills, measuring thirty-seven feet in circumference at the base, though rarely more than three feet high. They occur in groups, and in one site near Hollidaysburg, Pennsylvania, within a space of fifty acres, the writer counted seventeen hundred well-developed mounds. At two other localities in these mountains, similar groups were observed even more thickly placed. At "Pine Hill," about thirty acres were occupied, of which five were found to contain two hundred and ninety-three mounds, an average of fifty-nine to the acre, or eighteen hundred for the whole section. At "Warrior's Mark," another large settlement of nearly two hundred hills was visited. Experiments made in the Hollidaysburg group proved that all therein formed substantially one community, in complete fellowship, although the individual mounds appeared to be conducted independently" (pp. 3-5).

Dr. Forel's comment on these observations is:—"These ant kingdoms have in all probability a population of two hundred to four hundred million inhabitants, all forming a single community, and living together in active and friendly intercourse" (quoted at p. 8).

Again, with reference to the cutting ants of Texas, we read:—"A planter, in order to get rid of the depredations of an immense commune near his residence, had set his men to dig it up and utterly root it out. In order to reach the central nest he had traced the ants from a tree inside his home premises, which they had stripped of leaves, to a point six hundred and sixty-nine feet distant. The nest occupied a space as large as a small cellar, the lowest and main cave being as large as a flour-barrel. In this central cavern were great numbers of winged males and females, and innumerable larvæ and workers. From this point radiated the various avenues over which the leaf-cutters marched on their raids" (p. 64).

We could quote equally interesting passages from almost every page of this fascinating volume; but before concluding, we may note that Dr. McCook attaches great importance to the sense of smell in ants.

The numerous text-illustrations are of unusual excellence.

*Sextant Errors.* By Thos. Y. Baker. Pp. 32. (London: J. Griffin and Co., 1909.) Price 1s. net.

MR. BAKER has supplied a very excellent shillingworth for those who have occasion to use the sextant and wish to understand it properly. Every text-book gives the simple theory of the instrument, and the more ordinary adjustments and tests for errors are generally enough understood, but when the complete theory of an astronomical instrument, worked out on the supposition that no part is quite perfectly made, is required, then only such elaborate books as, for instance, Chauvenet may be turned to with confidence. It will be a great convenience to the sextant user to find in this little book complete demonstrations, free from the usual omission of steps, unnecessary for the writer of